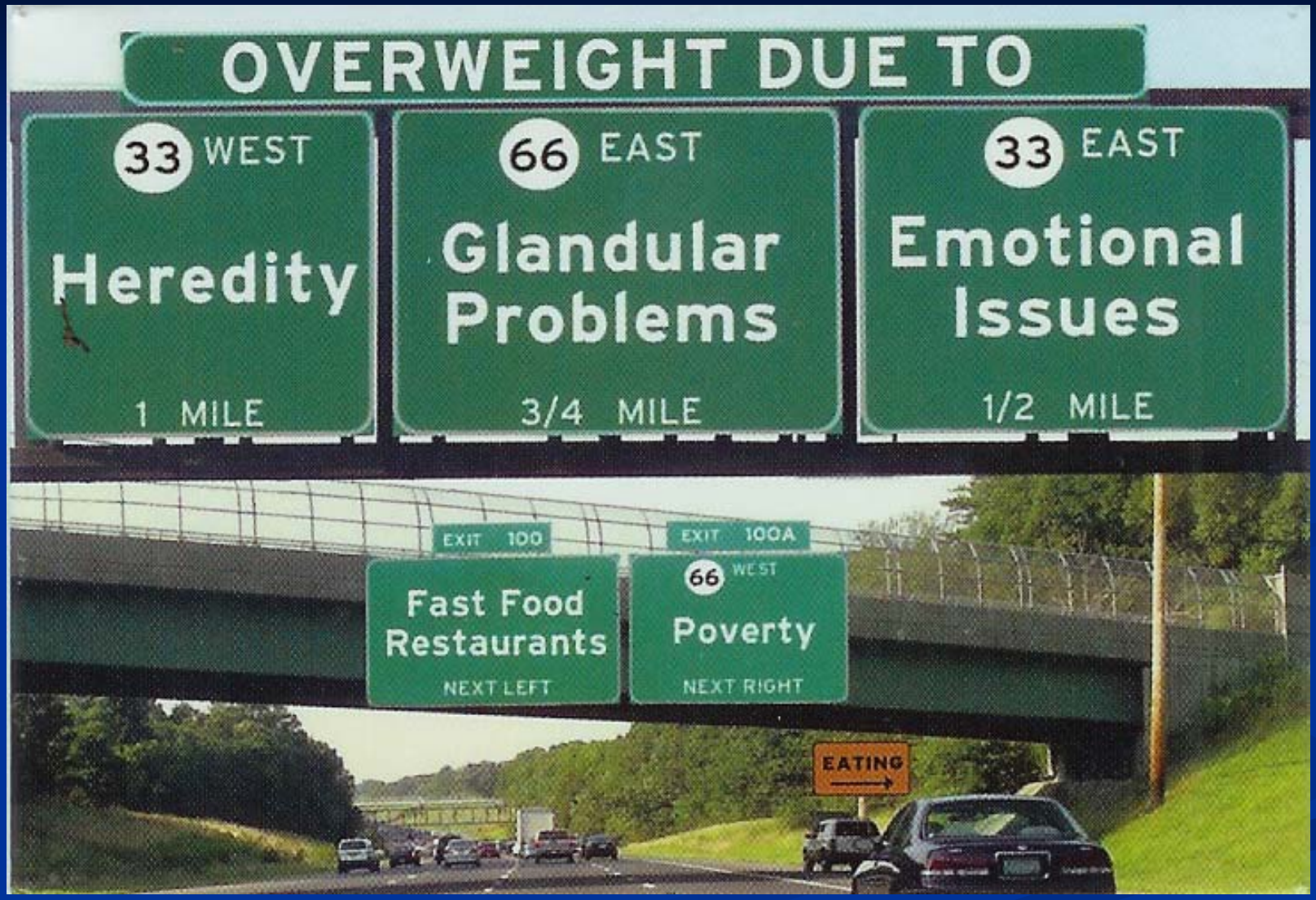
Type 2 Diabetes and Exercise

Donna Wahoff-Stice MS, APRN, FNP
Utah Diabetes Center
University of Utah
donna.wahoff-stice@hsc.utah.edu


OVERWEIGHT DUE TO
33 WEST
Heredity
1 MILE
66 EAST
Glandular Problems
3/4 MILE
33 EAST
Emotional Issues
1/2 MILE
EXIT 100
Fast Food Restaurants
NEXT LEFT
EXIT 100A
66 WEST
Poverty
NEXT RIGHT
EATING

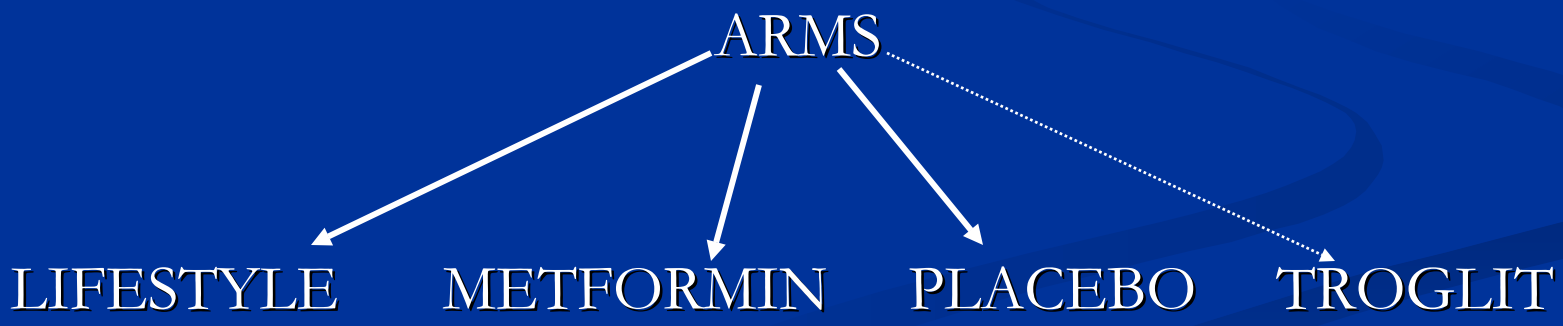

MIKE SMITH
UNITED FEATURE SYN.
SMITHTOONS.COM
WEAPONS OF MASS EXPANSION.
JACK IN THE BOX
TACO BELL
KFC
McDonald's
BURGER KING
Wendy's
NEWS
SIX IN TEN AMERICANS OVERWEIGHT
NEWS

Benefits of Exercise in Diabetes

- Lowers blood sugar. (50 mg/dl with 45" moderate)
- Lowers insulin resistance (greater with exercise than weight loss alone)
- Helps to control weight (10 fold increase in fat oxidation)
- Can result in decreased need for medications
- Improved control/A1c can reduce complications
- Improves circulation
- Improved mood, attitude and self-esteem

DIABETES PREVENTION TRIAL

- NIH sponsored 5 year trial involving 3234 subjects (completed ~2003)
- 32% Male and 68% Female
- Designed to test strategies to delay the development of DM in high risk IGT pts



Eligibility Criteria

- Minimum age 25
- BMI 24 or > (22 in Asian)
- FBS 95-125
- BG 140-199 2 hours post OGGT

Ethnic Populations

- Caucasian – 53.8-56.1%
- African American – 18.9-20.6%
- Hispanic – 15.1-16.5%
- Native American – 4.8-5.6%
- Asian – 3.4-5.3%

Placebo Group

- Placebo medication QD
- Placebo BID after one month
- Standard Lifestyle Recommendations
  - 20-30 minute individual session + handouts
  - Food Guide Pyramid / NCEP Step 1 diet
  - Increase Physical Activity

Metformin Group

- 850 mg QD
- 850 mg BID after one month
- Standard Lifestyle Recommendations
  - 20-30 minute individual session + handouts
  - Food Guide Pyramid / NCEP Step 1 diet
  - Increase Physical Activity

Intensive Lifestyle Group

- Achieve & Maintain 7% weight loss
  - Low calorie / low fat diet
  - 150 minutes exercise per week
  - 16 lesson curriculum taught 1 on 1
  - Monthly group or individual follow-up

DIABETES PREVENTION TRIAL

- DPP results released August 2001 (subjects were followed for 2.8 years) and published 2002

  Metformin reduced prgression 31%

  (95%CI 17-43%)

  Dose 850 mg BID

  Lifestyle intervention reduced progression to diabetes 58% (95% CI 48-66%)

Average Weight Loss by Group

- Placebo – 0.1 Kg
- Metformin – 2.1 Kg.
- Lifestyle Intervention – 5.6 Kg.

Incidence of Diabetes by Group

- Placebo – 28.9%
- Metformin – 21.7%
- Lifestyle Intervention – 14.4%

Exercise and Type 2 Diabetes Effects on Glycemic Control

- Meta-analysis of studies of structured exercise effect on A1c and body mass in Type 2 DM
  - Total of 504 subjects, exercise & control groups did not differ at baseline
  - Structured exercise intervention
  - A1c significantly lower (7.65% vs 8.31%)
  - Post intervention body weight not significantly different
  - Effect is not mediated by weight loss

Broule NG, JAMA 286:1218-1227, 2001

Exercise and Type 2 Diabetes Effects on Overall Mortality

- Aerobics Center Longitudinal Study
  - 1,263 men with diabetes, subsample of >20,000 men
  - Cardio-respiratory fitness classified on exercise testing as low, moderate or high
  - 42% of diabetic men were classified as "low fit"
  - 50% of diabetic men were classified as "inactive"

Wei M, et al, Ann Intern Med 132: 605-611, 2000

Exercise and Type 2 Diabetes Effects on Overall Mortality

- Results
  - 11.7 years mean follow up
  - 180 deaths
  - Low-fit men had 2.2 fold greater mortality risk
  - Mortality in moderately fit men was 60% lower
    - After adjustment for age, baseline CVD, hypercholesterolemia, BMI, HTN smoking and baseline FBS
    - Moderate exercise mean time was 150 minutes per week for men and 130 minutes for women

Wei M, et al, Ann Intern Med 132: 605-611, 2000

Resistance Exercise

- Dunstan et al.
  - 36 sedentary type 2, aged 60-80 yo
  - 6 months moderate weight loss and high intensity resistance training (3 sets of 8-10 reps at 75-80% of maximal)
  - Results
    - 1.2% reduction in A1c and additional decrease in meds
    - Lean body mass increased by 0.5 kg

Dunstan et al, Diabetes Care 25: 1729-1736, 2002

Resistance Exercise

- 62 Hispanic men (22) and women (40)
- Mean age 66 years
- 16 weeks, supervised high intensity resistance, 3 sets of 8 reps of 5 exercises, 3 times per week
- Results
  - 1% reduction in A1c & additional decrease in meds
  - Systolic BP mean decline of 9.7 mm Hg
  - Decline in free fatty acids

Castenada et al, Diabetes Care, 25: 2335-2342, 2002

Summary

- Exercise works! Both for pre-diabetes and type 2
- Increases insulin sensitivity and decreases insulin resistance
- Improves A1c
- Promotes weight loss
- Decreases Mortality

Evaluation Prior to Exercise Program

- Complete Physical Exam: including foot, respiratory, cardiovascular, HTN
- Complication screening
- Exercise stress EKG
  - Age >40 yo, with or without CVD risk factors other than diabetes
  - Age >30 years and
    - Type or or 2 DM of >10 yrs duration
    - Hypertension
    - Tobacco use
    - Proliferative or preproliferative retinopathy
    - Nephropathy, including microalbuminuria

Evaluation Prior to Exercise Program

Exercise Stress EKG

- Any of the following regardless of age
  - Known or suspected CAD, Cerebral Vascular disease and/or Peripheral Vascular disease
  - Autonomic neuropathy (thallium stress test)
  - Advanced nephropathy or renal failure

* Clinician "gut feeling"

Medical Conditions potentially Limiting Strenuous Exercise

- Hypoglycemic unawareness
- Proliferative Diabetic Retinopathy
- Persistent Hyperglycemia
- Uncontrolled Hypertension
- Significant Peripheral Sensory Neuropathy
- Autonomic Insufficiency
- Coronary Artery Disease
- Peripheral Vascular Disease
- Significant Proteinuria
- Nephropathy
- Non Adherence to medical regimen

Hyperglycemia / Hypoglycemia

- Delay exercise if BG >300 mg/dl or urine ketones
- Optimal time to exercise 1-3 hours post meal
- SMBG- before, during, after
- If BG is <80 consume 15-20 gms carb
- BG start goal range 100-200 mg/dl
- 15-20 grams carbs for prevention, may need additional every 30-60 minutes
- May need reduction in insulin dose 25-75%
- Post exercise hypoglycemia
- Individualize

Carbohydrate Sources equal to 15 grams

- ½ cup of regular soda
- ½ cup of orange, apple, grapefruit juice
- 2 tablespoons of sucrose dissolved in water
- 1 tube (15 gm) of Glutose 15
- 2 tablespoons of raisins
- 3 glucose tablets (5 gm each)
- 6-8 oz of milk
- 8-10 hard candies
- 1 cup Gatorade

Diabetes Complications and Exercise

- Retinopathy- need dilated exam
  - Normal or mild BDR, no restriction
  - Proliferative retinopathy- no strenuous or static
- HTN-
  - Exercise induced HTN: Peak systolic pressure 210 mm Hg men and 190 mm Hg women
  - Low static demand sports/exercise
  - Do need conditioning

Diabetes Complications and Exercise

- Nephropathy-
  - No evidence that exercise exacerbates fixed diabetic neuropathy
  - Can cause transient increase in urine protein excretion
  - Monitor microalbumin creatinine ratio annually and serum creatinine periodically
  - Diabetic nephropathy and retinopathy are linked

Diabetes Complications and Exercise

- Neuropathies
  - Peripheral sensory – do motor /sensory foot exam
    - Most common, injury can result from increased pain threshold / loss of sensation
    - Motor nerve dysfunction results in weakness – will not be able to build muscle mass
  - Autonomic –
    - Determine BP and pulses response to orthostatic and Valsalva maneuvers
    - Gastroparesis

Exercise Program Components

- Type
  - Aerobic
  - Strength or Resistance Training
  - Flexibility
  - Core
- Frequency
  - Fitness 3-5 times per week
  - Weight loss 5-7 times per week
  - No more than 72 hours between sessions

Exercise Program Components

- Intensity
  - 60-85% maximal heart rate
  - 220 minus age
  - Stress testing
  - RPE
- Time
  - 20-60 minutes
  - Start low / go slow
  - Minimum of 150 minutes per week for weight loss

ACTIVITIES THAT I ENJOY

Walking | Water Aerobics | Running | Dancing

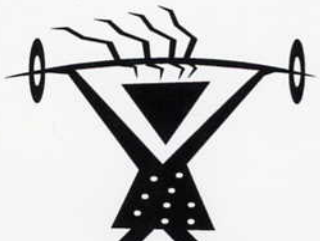
Biking | Swimming | Gardening | Golfing

Yoga | Step Aerobics | Tennis | Pilates

Others:

New exercises I can do at home:

1. _____
2. _____
3. _____
4. _____
5. _____



Activities

- Pedometer and 10,000 steps
- Dancing to ethnic music
- Family walking
- Mall walking
- Indoor bike
- Video
- Snowshoeing
- Ice skating

Barriers to Exercise - Sharks

- Illness and physical limitations
- Lack of time
- Demands from family, friends, or job
- Inclement weather
- Boredom
- Lack of motivation

SET SMART GOALS

S-M-A-R-T

Specific, Measurable, Attainable, Relevant, Time-based

BARRIERS IN MY LIFE PREVENTING ME FROM EXERCISING:

1. _____
2. _____
3. _____

HOW TO OVERCOME THOSE BARRIERS:

1. _____
2. _____
3. _____

CHANGING BEHAVIORS

Behavior I would like focus on changing: _____

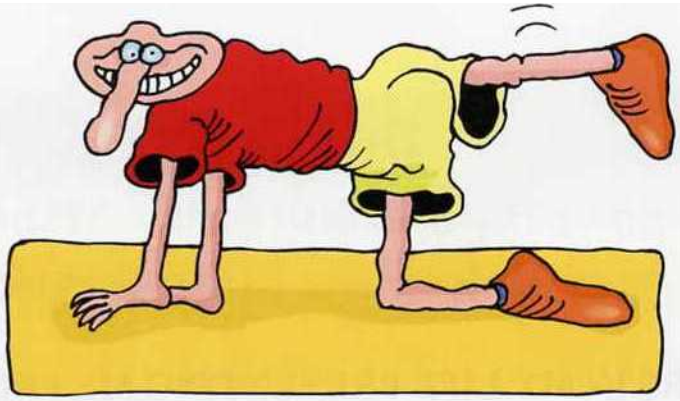
_____

Ways to change this behavior: _____

_____

Benefits of changing this behavior: _____

_____



My Fitness Goals

Goal 1: _____

Plan of Action:

_____

_____

Goal 2: _____

Plan of Action:

_____

_____

Goal 3: _____

Plan of Action:

Keep It Going

- Time to gain a habit
- Have a set time (am greater success)
- Maintain while on vacation or sick
- Journal or log
- Someone to do it with!

- Additional References:
  - Sigel R., et al. Physical Activity/Exercise and Type 2 Diabetes, Diabetes Care 27: 2518-2539, 2004.
  - Hornsby W., et al. Management of Competitive Athletes with Diabetes, Diabetes Spectrum 18: 102-107, 2005.
  - Mullooly C., et al. Diabetes Educators and the Exercise Prescription, Diabetes Spectrum 18: 108-113, 2005.
  - Kriska A., et al. Fishes, Whales and Fishing Tips: Hooking an Active Lifestyle, Diabetes Spectrum 18: 114-118.